Federal State Autonomous Educational Institution
Higher Education "Peoples' Friendship University of Russia"

Agrarian-Technological Institute
(name of the main training unit (PMO) - the developer of the EP HE)

WORK PROGRAM OF THE DISCIPLINE
Biotechnology in plant protection
(name of discipline/module)

Recommended by ISSS for the direction of training/specialty:
35.04.04 **Agronomy**
(code and name of the direction of training/specialty)

The development of the discipline is carried out within the framework of the implementation of the main professional educational program of higher education (EP HE):
Agronomy
(name (profile/specialization) ep he)

2022

1. CONCENTRATIONOF DISCIPLINE

The purpose of the course is the formation of theoretical knowledge and familiarization with the practical problems of implementing biotechnological methods and techniques in the production of healthy planting material of vegetatively propagated agricultural and ornamental crops, in obtaining plant forms with fundamentally new properties and qualities within economically significant species, in the mass production and use of biological products with antibacterial, fungicidal and insecticidal activity.

2.REQUIREMENTS FOR THE RESULTS OF MASTERING THE DISCIPLINE:

Mastering the discipline "Biotechnology in plant protection" is aimed at forming the following competencies (part of the competencies) among students:

Table 1 - The list of competencies formed by students during the development of the discipline (the results of mastering the discipline)

Code	Competence	Competency Achievement Indicators
UK-1	Able to carry out search, critical analysis of problem situations on the basis of a systematic approach, to develop an action strategy	UK-1.3 Develops a strategy for achieving the set goal as a sequence of steps, anticipating the result of each of them and assessing their impact on the external environment of the planned activity and on the relationships of the participants in this activity
UK-2	Able to manage the project at all stages of its life cycle	UK-2.1 Develops the concept of the project within the framework of the designated problem, formulating the goal, objectives, relevance, significance (scientific, practical, methodological and other depending on the type of project), expected results and possible areas of their application UK-2.2 Forms a schedule for the implementation of the project as a whole and a plan for monitoring its implementation, organizes and coordinates the work of project participants UK-2.3 Offers possible ways (algorithms) of implementation of the project results into practice (or implements it)
OPK-1	Able to solve the problems of development of the field of professional activity and (or) organization on the basis of analysis of the achievements of science and production	OPK-1.1 Demonstrates knowledge of the main methods of analyzing the achievements of science and production in agronomy OPK-1.2 Uses methods of solving problems in the development of agronomy based on the search and analysis of modern achievements of science and production OPK-1.3 Applies available technologies, including information and communication technologies, to solve the problems of professional activity in agronomy
OPK-4	Able to conduct research, analyze	OPK-4.2 Uses information resources,

	results and prepare reporting documents	scientific, experimental and instrumental base for research in agronomy
PK-1	Able to collect, process, analyze and systematize scientific and technical information, domestic and foreign experience in the field of agronomy	PC-1.1 Performs critical analysis of the information received
PK-2	Able to develop methods of conducting experiments, master new research methods	PK-2.1 Develops methods for conducting experiments

3.THE PLACE OF DISCIPLINE IN THE STRUCTURE OF THE OP VO:

The discipline "Biotechnology in Plant Protection" refers to the variable part of block B1 op VO.

Within the framework of the OP HE, students also master other disciplines and / or practices that contribute to the achievement of the planned results of the development of the discipline "Biotechnology in Plant Protection".

Table 2 – List of components of the HE OP that contribute to the achievement of the planned results of the discipline

Code	**Competence**	**Previous disciplines/modules, practices**	**Subsequent disciplines/modules, practices**
UK-1	Able to carry out search, critical analysis of problem situations on the basis of a systematic approach, to develop an action strategy	Research Practice Plant protection in organic farming Organization of integrated plant protection systems	Graduation qualification work Preparation and passing of the state exam
UK-2	Able to manage the project at all stages of its life cycle	Instrumental research methods Mathematical modeling and design Biological method of plant protection Organization of integrated plant protection systems	Plant immunity Graduation qualification work Preparation and passing of the state exam
OPK-1	Able to solve the problems of development of the field of professional activity and (or) organization on the basis of analysis of the achievements of science and production	Biology of weedy vegetation Plant protection in organic farming Nematode diseases	Virology Plant Quarantine Molecular Methods for Diagnosing Phytopathogens Bacterial Diseases
OPK-4	Able to conduct research, analyze results and prepare reporting documents	Instrumental research methods Mathematical modeling and design	Plant immunity Graduation qualification work Preparation and

			passing of the state exam
PK-1	Able to collect, process, analyze and systematize scientific and technical information, domestic and foreign experience in the field of agronomy	Plant quarantine Pest and disease prognosis Pre-diploma practice	Plant immunity Graduation qualification work Preparation and passing of the state exam
PK-2	Able to develop methods of conducting experiments, master new research methods	Instrumental research methods Mathematical modeling and design	Plant immunity Graduation qualification work Preparation and passing of the state exam

4. SCOPE OF DISCIPLINE AND TYPES OF EDUCATIONAL WORK

The total labor intensity of the discipline is 3 credits.

4.1. Types of educational work by periods of mastering the EP HE for full-time education

Type of educational work	Altogether	Semesters	
		7th	8th
Total labor intensity, hour	108	108	
Contact work	45	45	
Lecture	15	15	
Seminars	30	30	
Independent work	55	55	
Control	8	8	

4.2. Types of educational work by periods of mastering the EP HE for full-time and part-time education

Type of educational work	Altogether	Semesters	
		3rd	4th
Total labor intensity, hour	108	108	
Contact work	34	34	
Lecture	-	-	
Seminars	-	-	
Independent work	49	49	
Control	25	25	

4.3. Types of educational work by periods of mastering the EP HE for part-time education

Type of educational work	Altogether	Semesters	
		3rd	4th
Total labor intensity, hour	108	108	
Contact work	15	15	
Lecture	15	15	
Seminars	-	-	
Independent work	84	84	
Control	9	9	

5. THE CONTENT OF THE DISCIPLINE.

5. 1. Contents of the discipline sections

No p/n	Name of the discipline section	Contents
1.	Modern problems of biotechnology in crop production and its biosafety	Modern achievements of biotechnology. The level of research in developed and developing countries of the world. Biosafety of genetically modified objects of animal origin. Biosafety of genetically modified objects of plant origin. The role of food chains in the distribution and utilization of GMO producers. The need for control and restrictions in the field of GMO production.
2.	Rehabilitation of vegetative-propagating plants, their reproduction and distribution	Harmfulness of plant viruses by economically important species, symptoms of disease manifestations. Obtaining and reproduction of healthy planting material of vegetative-propagated plants. Features of its distribution and quality control. Minimizing the size of the original meristematic material. Methods, techniques and technologies of plant healing. Thermotherapy and chemotherapy. Invitro cloning technology. Modern methods of diagnosis and control of viral infection. Certification scheme of healed planting material of higher categories
3.	Increasing the resistance of agricultural plants to pathogens and environmental factors	Creation of forms and varieties resistant to diseases, pests, herbicides and adverse environmental factors using GMO technologies. Introduction of fragments of foreign genes into the genome of economically significant species. The emergence of forms with fundamentally new properties. Invulnerability of plants by pests and diseases, their resistance to environmental factors
4.	Production of biological preparations, their effectiveness, preparative forms and application	Search and selection of the most aggressive in natural conditions strains of parasitic organisms of pests and diseases of agricultural plants. Development and production of immunomodulators and biological preparations for the control of pests and diseases of agricultural crops. Features of their application and storage. Reduction and elimination of the use of synthetic highly toxic pesticides, the frequency of their use

5.2. Sections of disciplines and types of classes

No p/n	Name of the discipline section	Lecs.	Semin	CPC	Counter.	All-go hour.

1.	Modern problems of biotechnology in crop production and its biosafety	6	6	15		27
2.	Rehabilitation of vegetative-propagating plants, their reproduction and distribution	13	13	14		39
3.	Increasing the resistance of agricultural plants to pathogens and environmental factors	13	13	13		39
4.	Production of biological preparations, their effectiveness, preparative forms and application	13	13	13		39
	Just an hour.	45	45	55	8	108

6. Laboratory workshop

(not provided)

7. Practical exercises (seminars)

No p/n	Discipline Section No	Topics of practical exercises (seminars)	Work Capacity (hours)
1.	1	Biosafety of genetically modified objects of animal and plant origin.	3
2.	1	The role of food chains in the distribution and utilization of GMO producers	3
3	2	Harmfulness of plant viruses by economically important species, symptoms of disease manifestations	4
4.	2	Methods, techniques and technologies of plant healing.	2
5.	2	Modern methods of diagnosis and control of viral infection.	4
6.	2	Certification scheme of healed planting material of higher categories	4
7.	3	Biotechnological methods for increasing plant resistance to phytopathogens	4
8.	3	Biotechnological methods to increase the resistance of plants to environmental factors	2
9.	4	Biotechnological methods of development and production of biological products for the fight against fungal diseases	4
10.	4	Biotechnological methods of development and production of biological products for pest control	3
11.	4	Biotechnological methods of development and production of biological preparations for weed control	3
12.	4	Features of application and storage of biological products	2
	Total		36

8. Material and technical support of the discipline:

1. Classrooms equipped with multimedia projectors.
2. Computer classes of ATI, the information library center of RUDN University with access to the electronic library system of RUDN University, the Internet.
3. Full-featured biotechnological laboratory of rehabilitation and primary reproduction of agricultural plants

9. Information support of discipline

(a) Software:

- Windows 7 Enterprise
- Microsoft Office.
- AdobeAcrobat.

b) databases, reference and search engines:

http://quakes.globalincidentmap.com/,
http://www.globalincidentmap.com/,
http://earthquake.usgs.gov/earthquakes/recenteqsww/Quakes/quakes_all.php,
http://www.tesis.lebedev.ru/forecast_activity.html
Electronic library system RUDN University – EBS RUDN University:
http://lib.rudn.ru:8080/MegaPro/Web
RUDN University Educational Portal (http://web-local.rudn.ru);
University Library Online: http://www.biblioclub.ru
National digital resource "RUKONT": http://rucont. ru
IQlib: http://www.iqlib.ru
ScienceDirect: http://www. sciencedirect. com
EBSCO: http://search.ebscohost.com
Sage Publications:http://online.sagepub.com
Springer/Kluwer:http://www.springerlink.com
Tailor & Francis: http://www.informaworld.com
Web of Science: http://www.isiknowledge.com
University Information System RUSSIA: http://www. cir. ru/index. jsp
U chebny portal RUDN University: http://web-local.rudn.ru/
Http://www.studmedlib.ru Student Advisor

10. Educational and methodological support of the discipline:

Main literature:

1. Biotechnology – agro-industrial complex // V.I.Artamonov. – M.:Nauka, 1989 – 160 p.

2. Lewin. B. Geny, Publishing House "Mir", 1987

3. Mamontov S.G., Zakharov V.B. Obshchaya biologiya. M.; Ed. "Higher School", 1996

Molecular Biology (Structure and Biosynthesis of Nucleic Acids, Graduate School, 1990.

4. Muromtsev G.S., Butenko R.G., Tikhonenko T.I., Prokofiev M.I. Fundamentals of agricultural biotechnology. M.: Agropromizdat, 1990. - p. 384

5. Pomazkov Yu.I., Zaets V.G. Biological protection of plants (short course). – M.: Izd-vo RUDN. - 1997. – 116 p.

6. Agricultural biotechnology: Textbook /V.S.Shevelukha, Kalashnikova E.A. et al.; Ed. by V.S.Shevelukhi – 2nd ed. pererab. i dop. – M.: Vysshaya. shk., 2003. p. 468.

7. Chenikalova, E.V. Biotechnology in plant protection: a workshop on the performance of laboratory work. - Stavropol: AGRUS stavropolskogo gosudarstvennogo agrarianskogo universiteta, 2013. – 108 p.

8. Chulkina, V. A. Integrated plant protection: phytosanitary systems and technologies: a textbook for universities on agron. Specialties. - M.: Kolos, 2009. - 670 p. - (Textbook. Gr. MSH RF)

9. Sternshis M. V.Biotechnology in plant protection : Ucheb. Posobie–MSH RF. Novosibirsk :Novosib. gos. agrarian. un-t, 2001. - 153 s

11. Methodical instructions for students.

Academic requirements for students. Students are required to attend lectures, seminars, practical and laboratory classes, mandatory participation in certification tests. Grades are made on the basis of the results of studying the subject demonstrated by students throughout the training. The final assessment is determined by the sum of the points received by students for various types of work during the entire period of study provided for by the curriculum.

The study of this course involves the development of theoretical material in lectures and seminars, as well as the clarification and deepening of the knowledge gained during seminars and practical classes, serious independent work of the master on the study of the basics of biotechnology, educational and scientific literature.

Lecture classes (theoretical course). At lectures, the master, as a rule, gets acquainted with the materials of the topic for the first time. The teacher reveals the most important, fundamental questions of each topic that contribute to understanding the logic of the course construction. The lecture also explains the questions that cause the greatest difficulties for masters to understand.

Lectures may be accompanied by slides and other forms of visualization. It is possible to photograph the presented material or conduct an audio recording of the lecture only with the permission of the teacher.

At the lecture, the master can ask questions on the problems that interested him, answer the teacher's questions. You can approach the teacher after the lecture and discuss in more detail the master's interest or unclear question for him. The Master is entitled to receive individual advice from the lecturer.

Recommendations: It is better to keep notes of lectures, leaving room for supplementing them with notes in seminar classes, excerpts from the textbook and scientific literature.

Before the lecture, it is advisable to read notes on the previous topic. You can familiarize yourself in advance with the questions raised for the upcoming lecture by reading the relevant paragraphs in the textbook.

Seminar (practical) classes. At the seminar classes, the master gets the opportunity to study the topic more deeply, clarify theoretical and obtain practical knowledge, form professional skills. The forms of conducting seminar classes are diverse and are chosen by the teacher depending on the topic being studied and the characteristics of the preparation of masters. At the seminar classes, the methods and forms of both individual and collective work of masters are used.

In case of missing seminar classes, the master must, in agreement with the teacher leading the seminar classes, prepare and submit the appropriate material.

Recommendations: When studying the topics submitted for discussion at the seminar lesson, it is necessary to study first the lecture notes, and then the corresponding section (chapter) of the textbook for universities. At the same time, it is useful to use the textbooks of different authors,

comparing their views on a particular issue. Similar work is expected in the preparation of tasks for practical classes and tests, including for solving problems.

Independent work of masters. A special place among the main types of classes provided for in the curriculum is occupied by independent work, which involves a detailed study of the material and special literature on this course.

Recommendations: Starting an independent study of the issues, the master needs to determine their place in the course program, get acquainted with the content of each topic.First, you should work out the material recorded at the lecture, then study the relevant sections of the textbook.

Agrobiotechnology Department

APPROVED
at a meeting of the Department
"___"__No_____
Director of The Department
_____ Pakina E.N.
(Signed)

VALUATION FUND

BY DISCIPLINE

Biotechnology in plant protection
(name of the discipline)

35.04.04 "Agronomy".
(code and name of the direction of training)

Master

Kvalicification (degree) of the graduate

Passport of the foundation of appraisal<u>means of discipline.</u>
<u>Biotechnology in plant protection</u>
Field of study: Agronomy. Master's degree

Code of a supervised competency or part of it	Controlled discipline section	Controlled theme of discipline	Name of the appraisal tool					Points Themes	Section Points
			Current control				Intermediate attestation		
			1st coloquium, points test	2nd coloquium, yallı test	3rd coloquium, points test	4th coloquium, points test	Exam/Credit		

UK-1, UK-2	1.Modern tasks of biotechnology in crop production and its biosecurity	Biosafety of genetically modified objects of animal and plant origin. The role of food chains in the distribution and utilization of GMO producers	25						
OPK-4, OPK-7	2. Improvement of vegetative-propagating plants, their reproduction and distribution	Harmfulness of plant viruses by economically important species, symptoms of disease manifestations Methods, techniques and technologies of plant healing Modern methods of diagnosis and control of viral infection. Certification scheme of healed planting material of higher categories		25					
About PK-1, OPK-4	3.Increasing the resistance of agricultural plants to pathogens and environmental factors Environment	Biotechnological methods to increase the resistance of plants to phytopathogens Biotechnological methods to increase the resistance of plants to environmental factors			25				
OPK-4, PK-1 PK-2	4. Production of biological products, their effectiveness, preparative forms and applications	Biotechnological methods for the development and production of biological products for the control of fungal diseases Biotechnological methods for the development and production of biological products for pest control				25			
							100		

Ball-rating system implemented to assess knowledge in the discipline

The form of implementation of the ball-rating system of training and assessment of knowledge on the course **"Biotechnology in plant protection"** was developed on the basis **of**

the Regulations on the Point-rating system for assessing the quality of mastering the main educational programs of 17.06. 2013, Protocol No. 6, approved by the Order of the Rector No. 564 of 20.06.2013)

During the semester, the assessment of students' knowledge in the discipline "**Biotechnology in Plant Protection**" is carried out on a 100-point scale at the rate of 4 (four) attestations of 25 questions each, which are carried out after mastering a certain part of the theoretical and practical material of the discipline. Attestations are carried out in written/test mode. Question 1 is scored by 1 point. Within a week, after an unsatisfactory attempt by any criteria on the designated day, it is possible to repeat the attestation in oral mode. There are no points for attending classes. Students who allowed absences from classes during the certification period without good reasons are certified exclusively orally in the amount of material covered. Students who score less than 50% of possible points on the next certification, the development of the topic is not counted. According to the subject of the material covered, the student performs an essay, the compliance of which is assessed by the teacher during the interview and, with a positive result, the minimum allowable score for certification (51%) is set.
If the student wishes to improve the grades, it is allowed to pass the exam in the passed discipline at the appropriate time of the session, but the change in the score applies only to the neighboring category and to the extent of the difference in points between the categories.

Evaluation criteria:

(*in accordance with the current regulatory framework*)

Compliance of grading systems (previously used grades of final academic performance, ECTS grades and the point-rating system (BRS) of assessments of current academic performance).

BRS Scores	**Traditional Assessments of the Russian Federation**	**Evaluation ECTS**
95 - 100	5	A
86 - 94		B
69 - 85	4	C
61 - 68	3	D
51 - 60		E
31 - 50	2	FX
0 - 30		F
51-100	Credit	Passed

Explanation of the rating table:
Description of ECTS ratings

A	**"Excellent"** - the theoretical content of the course is mastered completely, without gaps, the necessary practical skills of working with the mastered material are formed, all the educational tasks provided for by the training program are completed, the quality of their implementation is estimated by the number of points close to the maximum**.**
B	**"Very good"** - the theoretical content of the course is mastered completely, without gaps, the necessary practical skills of working with the mastered material are mainly formed, all the educational tasks provided for by the training program are completed, the quality of most of them is estimated by the number of points close to the maximum.
C	**"Good"** - the theoretical content of the course is mastered completely, without gaps, some practical skills of working with the mastered material are not sufficiently formed, all the educational tasks provided for by the training program have been completed, the quality of none of them is assessed by a minimum number of points, some types of tasks are performed with errors**.**

D	**"Satisfactory"** - the theoretical content of the course is partially mastered, but the gaps are not significant, the necessary practical skills of working with the mastered material are mainly formed, most of the educational tasks provided for by the training program have been completed, some of the completed tasks may contain errors.
E	**"Mediocre"** - the theoretical content of the course is partially mastered, some practical skills are not formed, many of the training tasks provided for by the training program have not been completed, or the quality of some of them is estimated by the number of points close to the minimum.
FX	**"Conditionally unsatisfactory"** - the theoretical content of the course has been partially mastered, the necessary practical skills of work have not been formed, most of the educational tasks provided for by the training program have not been completed, or the quality of their implementation is estimated by a number of points close to the minimum; with additional independent work on the course material, it is possible to improve the quality of the performance of educational tasks.
F	**"Certainly unsatisfactory"** - the theoretical content of the course has not been mastered, the necessary practical skills of work have not been formed, the all-completed training tasks contain gross errors, additional independent work on the course material will not lead to any significant improvement in the quality of the performance of educational tasks.

Positive grades, in which the course is counted as completed by the student, are grades A, B, C, D and E.
A student who has received an **FX** grade in the discipline of the educational program is obliged, after consultation with the appropriate teacher, to successfully complete the required minimum amount of training work provided for in the training program within the time limits established by the training part, and to submit the results of these works to this teacher. If the quality of the work is considered satisfactory, the final FX score is increased to E and the trainee is allowed for further training.
In the event that the quality of the training work remains unsatisfactory, the final grade is reduced to F and the trainee is submitted for expulsion. In case of receiving an F or FX grade , the trainee is submitted for expulsion regardless of whether he has any other debts in other disciplines.

(Order of the Rector of RUDN University No. 996 of 27.12.2006)

Evaluation criteria:
(*in accordance with the current regulatory framework*)

№ p/n	**Indicators / Evaluation Criteria**	***Excellent***	***Ok***	***satisfactorily***	***unsatisfactorily***
1.	Completeness of the reflection of the necessary information in each question	Fully	Sufficiently	Partly	Not available

2.	Having the student's own comments in those sections where necessary.	Fully	Sufficiently	Partly	Missing
3.	Completeness and validity of the conclusion and conclusions	Fully substantiated	Sufficiently substantiated	Insufficiently substantiated	Not justified

Note:

1. An "excellent" grade is given if all the criteria are "excellent" and no more than one "good" criterion.
2. A rating of "good" is given if all the criteria are "good" and "excellent", no more than one criterion "satisfactory".
3. A rating of "satisfactory" is given if all evaluation criteria are positive, no more than one criterion is "unsatisfactory".
4. A rating of "unsatisfactory" is obtained against the criteria of more than one unsatisfactory rating.

Compiled by ____

Tests to control knowledge.

1. The gene-encoded product is necessary:

for cell reproduction

for life support

for invasion into tissues

2. Proteomics characterizes the state of microbial pathogen:

by enzymatic activity

by growth rate

. on the expression of individual proteins

3. To obtain protoplasts from fungal cells is used

trypsin

pepsin

amylase

4. The formation of protoplasts from microbial cells can be monitored using the following methods:

colorimetry

phase-contrast microscopy

Electron Microscopy

5. To obtain protoplasts from bacterial cells, the following is used:
lysozyme
"snail enzyme"
papain
6. Combining the genomes of cells of different species and genera in somatic hybridization is possible:
only in artificial conditions
in natural and artificial conditions
only with X-ray irradiation
7. High stability of protoplasts is achieved during storage:
in the cold:
in a hypertensive environment
in an environment with added antioxidants
8. Polyethylene glycol (PEG) introduced into the suspension of protoplasts:
promotes their fusion
prevents their merging
increases suspension stability
9. Suspension cultures are most suitable for
protoplastication: in the lag phase
in the stationary phase
in the logarithmic phase
10. Hybridization of protoplasts is possible if the cells of the original plants possess:
compatibility is not essential
the same size
high rate of reproduction
11. Transferases are carried out:
catalysis of addition reactions by double bonds
catalysis of reactions of transfer of functional groups to the substrate
catalysis of hydrolysis reactions
12. Monoclonal antibodies are obtained in the production of:
using a hybrid
chemical synthesis
biotransformation of polyclonal antibodies
13. The target for the action of mutagens in the cell are:
DNA

DNA polymerase
RNA polymerase
14. Sterilization in biotechnology is called: the destruction of all microorganisms and their resting forms
destruction of spores of microorganisms
creation of conditions that prevent the reproduction of producers
15. Direct transfer of foreign DNA into protoplasts is possible with the help
of: transformation
packaging in liposomes
protoplast cultivation on appropriate nutrient media
16. The substrates of restriction enzymes used by the genetic engineer are:
heteropolysaccharides
nucleic acids
Proteins
17. A "gene marker" is needed in genetic engineering:
to select colonies formed by cells into which the vector has penetrated
to include the "working gene" in the vector
to improve the stability of the vector
18. The concept of "sticky ends" in relation to genetic engineering reflects:
complementarity of terminal nucleotide sequences
interaction of nucleic acids and histones
formation of hydrogen bonds
19. The search for new restriction enzymes for use in genetic engineering is explained
by: the difference in catalytic activity
different place of influence on the substrate
species specificity
20. The ligase enzyme is used in genetic engineering because:
binds the vector to the shell of the host cell
catalyzes the inclusion of the vector in the chromosome of the host cell
catalyzes the covalent binding of the carbohydrate-phosphorus dna chain of the gene and the DNA vector
21. Easing restrictions on the use of recombinant microorganisms in industry has become possible thanks to:
improving methods for isolating genetically engineered recombinants from the environment
advanced training of personnel working with them

established experimentally weak viability of recombinant

22. A plasmid-based vector is preferable to a phage DNA vector due to:

greater frequency of inclusion

absence of host cell lysis

greater sustainability

23. Process air for biotechnological production is sterilized:

by heating

filtering

Irradiation

24. Auxins are a term under which specific growth stimulants are combined:

plant tissues

actinomycetes

animal fabrics

25. Screening

improvement through chemical transformation

improvement through biotransformation

search and selection ("sifting") of natural structures

26. Weak points" of the fermenter are called:

structures most susceptible to corrosion

structural elements in which depressurization is possible

hard-to-sterilize structural elements

27. Callus cultures need illumination for:

to carry out the processes of cellular differentiation

to initiate cell division processes

to initiate morphogenesis processes

28. Directed mutagenesis is:

the targeted use of certain mutagens to make specific changes to DNA coding sequences.

targeted selection of natural strains of microorganisms with beneficial traits

targeted effects of mutagens on certain enzyme proteins

29. The presence of a regulated promoter allows:

to carry out the synthesis of the target product at any stage of cell culture growth

carry out the synthesis of the target product regardless of temperature or oxygen concentration

carry out the synthesis of the target product regardless of the composition of the nutrient medium

30. "Antisense" is an oligonucleotide that:

hybridizes with a gene and blocks its transcription

encodes the synthesis of a protein that is not involved in metabolic processes
encodes protein synthesis with an incorrect structure
31. Ribozymes are:
specific RNA molecules with catalytic activity against other RNA molecules
these are the components of ribosomes
these are enzymes encoding the synthesis of RNA
32. Nutrient media for plant cell cultures differ from nutrient media for microorganisms and animal cells by the mandatory presence
of: carbohydrates
nitrogen and phosphorus compounds
phytohormones
33. The function of pheromones is:
antimicrobial activity
antiviral activity
changing the behavior of an organism that has a specific receptor
34. The basic requirement for gene targets in DNA diagnostics: the
target gene must be responsible for vital functions
the target gene must have specific restriction sites
the target gene must be specific to the genome of that particular pathogen
35. A bubbler is a device for:
feeding the nutrient medium into the fermenter
for supplying air (gas) to the fermenter
for fermenter sterilization
36. For reversible suction of proteins from aqueous solutions use:
copper sulfate
sodium hydroxide
benzene
37. Growing microorganisms in a closed system, without adding nutrients is called
continuous cultivation
extreme cultivation
periodic cultivation
38. The products of secondary metabolism are not
enzymes
antibiotics
aflatoxins

39. Enzymes are

proteins by their biochemical nature

proteins and RNA

nucleic acids

40. Bacteriophage by its biological nature is

a product of microbial transformation

genetic marker in screening procedures

virus bacteria

List of issues of the final certification in the discipline "Biotechnology in plant protection"

1. Goals and objectives of biotechnology in plant protection.
2. The main directions of biotechnological developments for plant protection.
3. The level of technology that ensures the achievement of high efficiency in the field of plant protection against pathogens.
4. The main problems of ecologization of agriculture.
5. Biosafety principles in agricultural production
6. The role of biotechnological approaches in stimulating the activity of the root system of plants
7. The main advantages of biotechnological methods over traditional schemes for ensuring plant resistance to biotic and abiotic factors
8. The use of thermotherapy in the process of plant healing
9. Basic principles of plant health and their distribution.
10. Features of the use of antibiotics as a means of combating plant pathogens.
11. Advantages of using biopesticides in insect control.
12. Fungi in the fight against insect pests.
13. Viruses in the fight against insect pests.
14. Pheromones in the fight against insect pests.
15. Preparative forms of bioinsecticides and features of their use.
16. Main biotechnological aspects of weed control
17. Components of herbicides of biotechnological origin and ways of their search.
18. New approaches to plant protection from adverse abiotic factors
19. Mechanisms and conditions for ensuring increased resistance of plants under stress.
20. Requirements for the safe production and distribution of biological products.

The program is drawn up in accordance with the requirements of the ES HE RUDN/FSES HE

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